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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/017,912

12/14/2001

Robert Dixon Roorda

81620A

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23685

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11/20/2003

KRIEGSMAN & KRIEGSMAN  
665 FRANKLIN STREET  
FRAMINGHAM, MA 01702

EXAMINER

GEISEL, KARA E

ART UNIT

PAPER NUMBER

2877

DATE MAILED: 11/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/017,912

Applicant(s)

ROORDA ET AL.

Examiner

Kara E Geisel

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 08 August 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-29 and 37-49 is/are pending in the application.
- 4a) Of the above claim(s) 30-36 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7, 12-14, 16-29, 37, 38, 40-44, 46, 48 and 49 is/are rejected.
- 7) ☒ Claim(s) 8-11, 15, 39, 45 and 47 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 April 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1201, 1002
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Election/Restrictions***

Applicant's election without traverse of Group I, claims 1-29 and 37-49, in the paper filed on August 8<sup>th</sup>, 2003 is acknowledged.

Claims 30-36 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the paper filed on August 8<sup>th</sup>, 2003.

### ***Information Disclosure Statements***

The information disclosure statements filed on December 14<sup>th</sup>, 2001, October 29<sup>th</sup>, 2002, and August 8<sup>th</sup>, 2003 has been fully considered by the examiner.

### ***Claim Objections***

Claim 15 is objected to because of the following informalities: minor typographical error.

In regards to claim 15, line 2, "long" should be changed to --along-- in order to change a typographical error

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application

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filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3-7, 16-17, 28-29, 37-38, 40-42, and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Bouzid (USPN 6,449,039), as cited by applicant.

In regards to claims 1 and 16, Bouzid discloses an apparatus for steering a beam of light (fig. 1) comprising an acousto-optical deflector (fig. 2, 31), and a spectrally dispersive element (fig. 2, 35), the deflector and the dispersive element being optically coupled to one another.

In regards to claims 3 and 28, the dispersive element is positioned behind the deflector (fig. 1).

In regards to claim 4, the dispersive element is oriented relative to the deflector so that the dispersive element disperses multi-chromatic light in a direction opposite to that dispersed by the deflector (column 3, lines 4-37).

In regards to claims 5 and 17, the dispersive element is constructed to disperse multi-chromatic light in an amount equally opposite to, for at least a portion of the multi-chromatic light that is dispersed by the deflector (column 6, lines 33-67).

In regards to claims 6-7 and 29, the dispersive element is a prism (column 3, lines 4-13).

In regards to claims 37, 40, and 44, Bouzid discloses a multi-photon excited fluorescence laser scanning microscope for forming a magnified image of a sample the sample containing fluorescent molecules which radiate photons of a first characteristic energy (column 3-4 lines 55-67 and 1-18, respectively and column 4, lines 46-50) comprising means for producing a scanning beam of ultrashort laser light pulses (column 3, lines 55-65 and column 4, lines 19-45) comprising a laser source (fig. 1, 11) for providing a beam of ultrashort laser light pulses comprising photons of a second characteristic energy, wherein the second energy is less than the first energy and wherein the simultaneous absorption of a plurality of the photons of the second characteristic energy by the fluorescent molecules causes the fluorescence of the molecules (column 4, lines 46-55), a first acousto-optical deflector optically coupled to the laser source for scanning the beam along a first axis (fig. 1, 33 and column 2, lines 46-55), a first

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spectrally dispersive element optically coupled to the first deflector, the first element being oriented relative to the first deflector so that the first dispersive element disperses multi-chromatic light in a direction opposite to that dispersed by the deflector (column 3, lines 4-37), means for focusing the scanning beam to a focal point within the sample to produce an illumination intensity sufficiently high only at focal point to produce molecular excitation and fluorescence of the sample by simultaneous absorption of at least two incident photons (fig. 1, 15, column 4, lines 1-5 and 46-50), means for detecting the fluorescence produced by the sample (fig. 1, 48), and means for using the detected fluorescence to form a magnified image of the sample (fig. 1, 54-55, and column 5, lines 30-39).

In regards to claims 38 and 41, the dispersive element is constructed to disperse multi-chromatic light in an amount equally opposite to, for at least a portion of the multi-chromatic light that is dispersed by the deflector (column 6, lines 33-67).

In regards to claim 42, the scanning beam producing means further comprises means for scanning the sample in a direction perpendicular to the first axis (column 2, lines 46-55).

Claims 1-4, 6, 16, and 27-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Bowen et al. (USPN 5,128,798).

In regards to claims 1 and 16, Bowen discloses an apparatus for steering a beam of light (fig. 1A), comprising an acousto-optical deflector (fig. 1A, 12 or 13), and a spectrally dispersive element (fig. 1A, 12 or 13), the spectrally dispersive element and deflector being optically coupled to one another.

In regards to claims 2 and 27, the spectrally dispersive element (fig. 1A, 12) is positioned in front of the acousto-optical deflector (fig. 1A, 13).

In regards to claims 3 and 28, the spectrally dispersive element (fig. 1A, 13) is positioned behind the acousto-optical deflector (fig. 1A, 12).

In regards to claim 4, the dispersive element is oriented relative to the deflector so that the dispersive element disperses multi-chromatic light in a direction opposite to that dispersed by the deflector (column 3, lines 36-67).

In regards to claim 6, the dispersive element is a second acousto-optical deflector (column 3, lines 36-45).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 12-14, 18-26, and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouzid (USPN 6,449,039) in view of Bowen et al. (USPN 5,128,798), both cited by applicant.

In regards to claim 12, Bouzid discloses an apparatus for steering a beam of light comprising a first beam deflections means for deflecting a beam along a first axis (column 2, lines 46-55), comprising a first acousto-optical deflector (fig. 1, 33 AOD), and a first spectrally dispersive element, the first dispersive element and the first AOD being optically coupled to one another, the first element being

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oriented relative to the first AOD so that the element disperses multi-chromatic light in a direction opposite to that dispersed by the first AOD (column 3, lines 4-37), the first element being constructed to disperse multi-chromatic light, for at least a portion of the light, in an amount equal to that dispersed by the AOD (column 6, lines 33-67), and a second beam deflection means for deflecting the beam along a second axis, the second axis being different from the first axis (column 2, lines 46-55). Bouzid does not disclose that the second deflector comprises an acousto-optical deflector (AOD) and a spectrally dispersive element. However, it is well known in the art that two acousto-optical deflectors can be used together to deflect light in two different directions, and it would be well known to use two AOD's to deflect light in two directions. For example, Bowen discloses two acousto-optical deflectors, the first deflector used to deflect light in a first direction, and the second deflector used to deflect light in a second direction different from the first direction (column 3, lines 42-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have both of the deflectors in Bouzid's device be acousto-optical deflectors.

Furthermore, since Bouzid's invention concerns utilizing a dispersive element to correct for spatial dispersion in the AOD (Bouzid column 2, lines 38-45), it would be obvious to have the second beam deflection means, which now comprises a second AOD, to also comprise a second spectrally dispersive element, the second element and second AOD being optically coupled to one another the second element being oriented relative to the second AOD so that the second element disperses multi-chromatic light in a direction opposite to the dispersed by the second AOD (Bouzid column 3, lines 4-37), the second element being constructed to disperse multi-chromatic light, for at least a portion of the light, in an amount equal to that dispersed by the second AOD (Bouzid column 6, lines 33-67) in order to correct for the spatial dispersion of the second AOD.

In regards to claim 13, the second axis is perpendicular to the first axis (Bouzid column 2, lines 46-55).

In regards to claim 14, the first beam deflections means is constructed to scan the beam over a plurality of contiguous locations along the first axis and where the second beam deflection means is constructed to scan the beam over a plurality of contiguous locations along the second axis (Bouzid column 4, lines 19-45).

In regards to claim 18, although it is disclosed that the beam of light is pulsed, it is well known in the art that a continuous light beam can also be used to scan a sample and cause the sample to fluoresce, and therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a continuous light beam instead of the pulsed light beam in Bouzid's apparatus in order to perform the same function of the light beam.

In regards to claim 19, the beam of light is a pulsed beam of light (column 3, lines 55-65).

In regards to claim 20 the beam of light is a beam of ultrashort light pulses (column 3, lines 55-65).

In regards to claim 21, the light pulses can have a pulse duration of less than one picosecond (column 3, lines 62-63).

In regards to claim 22, the light pulses can have a pulse duration of greater than or equal to one picosecond (column 3, lines 59-61).

In regards to claim 23-26, it is up to the user, and up to the type of sample being fluoresced to determine what the bandwidth and the wavelength range of the laser light should be.

In regards to claim 43, Bouvid's multi-photon laser scanning microscope is disclosed above. Bouzid does not disclose that the means for scanning the sample in a direction perpendicular to the first axis comprises an acousto-optical deflector (AOD) and a spectrally dispersive element. However, it is well known in the art that two acousto-optical deflectors can be used together to deflect light in two different directions, and it would be well known to use two AOD's to deflect light in two directions. For example, Bowen discloses two acousto-optical deflectors, the first deflector used to deflect light in a first

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direction, and the second deflector used to deflect light in a second direction different from the first direction (column 3, lines 42-46). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have both of the deflectors in Bouzid's device be acousto-optical deflectors.

Furthermore, since Bouzid's invention concerns utilizing a dispersive element to correct for spatial dispersion in the AOD (Bouzid column 2, lines 38-45), it would be obvious to have the second beam deflection means, which now comprises a second AOD, to also comprise a second spectrally dispersive element, the second element and second AOD being optically coupled to one another the second element being oriented relative to the second AOD so that the second element disperses multi-chromatic light in a direction opposite to the dispersed by the second AOD (Bouzid column 3, lines 4-37), the second element being constructed to disperse multi-chromatic light, for at least a portion of the light, in an amount equal to that dispersed by the second AOD (Bouzid column 6, lines 33-67) in order to correct for the spatial dispersion of the second AOD.

Claims 46, and 48-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bouzid (USPN 6,449,039).

In regards to claims 46 and 48, Bouzid discloses a laser scanning microscope for forming a magnified image of a sample, the sample containing molecules (column 3-4 lines 55-67 and 1-18, respectively and column 4, lines 46-50) comprising means for producing a scanning beam of ultrashort laser light pulses (column 3, lines 55-65 and column 4, lines 19-45) comprising a laser source (fig. 1, 11) for providing a beam of ultrashort laser light pulses comprising photons of a first wavelength capable of interacting with the molecules to create photons of a second wavelength, a first acousto-optical deflector optically coupled to the laser source for scanning the beam along a first axis (fig. 1, 33 and column 2, lines 46-55), a first spectrally dispersive element optically coupled to the first deflector, the first element being oriented relative to the first deflector so that the first dispersive element disperses multi-chromatic

light in a direction opposite to that dispersed by the deflector (column 3, lines 4-37), means for focusing the scanning beam to a focal point within the sample to produce an illumination intensity sufficiently high only at focal point to produce to generate photons of the second wavelength (fig. 1, 15, column 4, lines 1-5 and 46-50), means for detecting the photons of the second wavelength produced by the sample (fig. 1, 48), and means for using the detected photons to form an image of the sample (fig. 1, 54-55, and column 5, lines 30-39). Bouzid does not disclose that the microscope is a multi-harmonic generation laser scanning microscope, or that the sample contains molecules having the appropriate nonlinear susceptibility, however, the structure of the microscope is the same, and only the laser and the sample change to make this laser scanning microscope into a multi-harmonic generation laser scanning microscope, which would be up to the user. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to change the sample and the laser to change Bouzid's microscope to a multi-harmonic generation laser scanning microscope.

In regards to claim 49, Bouzid discloses a laser scanning microscope (column 3-4 lines 55-67 and 1-18, respectively and column 4, lines 46-50) comprising means for producing a scanning beam of laser light (column 3, lines 55-65 and column 4, lines 19-45) comprising a laser source (fig. 1, 11) for providing a beam of laser light (column 4, lines 46-55), a first acousto-optical deflector optically coupled to the laser source for scanning the beam along a first axis (fig. 1, 33 and column 2, lines 46-55), a first spectrally dispersive element optically coupled to the first deflector, the first element being oriented relative to the first deflector so that the first dispersive element disperses multi-chromatic light in a direction opposite to that dispersed by the deflector (column 3, lines 4-37), means for focusing the scanning beam to a focal point within the sample (fig. 1, 15, column 4, lines 1-5 and 46-50), non-confocal detection means for detecting multi-photon fluorescence produced by the sample (fig. 1, 48), and means for using the detected signal to form an image of the sample (fig. 1, 54-55, and column 5, lines 30-39). Bouzid does not disclose that the apparatus comprises confocal fluorescence detection means, and multi-

harmonic generation detection means. However, it is well known in the art to have multiple detection units to detect different properties of the sample, connected to the same microscope, since the structure of the microscope does not change for each type of detection. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to include a confocal fluorescence detection means, and multi-harmonic generation detection means into Bouzid's laser scanning microscope, since the main structure of the microscope would not change, and in order to measure other properties of the sample being tested.

*Allowable Subject Matter*

Claims 8-11, 15, 39, 45, and 47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

As to claim 8, the prior art of record, taken alone or in combination, fails to disclose or render obvious an apparatus for steering a beam of light wherein a spectrally dispersive element is positioned in front of an acousto-optical deflector, the apparatus further comprising a rotatable mirror, the mirror optically coupled to each of the deflector and the dispersive element and being positioned there between, in combination with the rest of the limitations of claim 8.

As to claim 10, the prior art of record, taken alone or in combination, fails to disclose or render obvious an apparatus for steering a beam of light wherein a spectrally dispersive element is positioned in front of an acousto-optical deflector, the apparatus further comprising a rotatable mirror, the mirror optically coupled to each of the deflector and the dispersive element and being positioned in front thereof, in combination with the rest of the limitations of claim 10.

As to claim 11, the prior art of record, taken alone or in combination, fails to disclose or render obvious an apparatus for steering a beam of light wherein a spectrally dispersive element is positioned

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behind an acousto-optical deflector, the apparatus further comprising a rotatable mirror, the mirror optically coupled to each of the deflector and the dispersive element and being positioned there between, in combination with the rest of the limitations of claim 11.

As to claim 15, the prior art of record, taken alone or in combination, fails to disclose or render obvious an apparatus for steering a beam of light wherein a first beam deflection means is constructed to scan a beam over a plurality of non-contiguous locations along a first axis and a second beam deflection means is constructed to randomly deflect the beam over a plurality of contiguous locations along a second axis, in combination with the rest of the limitations of claim 15.

As to claim 39, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method of imaging a sample using multi-photon excited fluorescence laser scanning microscopy wherein a step of passing a beam through a spectrally dispersive element is performed prior to a step of deflecting the beam using an acousto-optical deflector, in combination with the rest of the limitations of claim 39.

As to claim 45, the prior art of record, taken alone or in combination, fails to disclose or render obvious a laser scanning microscope for forming a magnified image of a sample wherein a first spectrally dispersive element is positioned between a beam providing means and a first acousto-optical deflector, in combination with the rest of the limitations of claim 45.

As to claim 47, the prior art of record, taken alone or in combination, fails to disclose or render obvious a method of imaging a sample using multi-harmonic generation laser scanning microscopy wherein a step of passing a beam through a spectrally dispersive element is performed prior to a step of deflecting the beam using an acousto-optical deflector, in combination with the rest of the limitations of claim 47.

***Additional Prior Art***

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The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The prior art made of record is Kobayashi (USPN 5,936,764), and Hartmann et al. (USPN 6,525,812).

Kobayashi discloses a laser scanning optical microscope with an acousto-optical deflector and a spectrally dispersive element, both in front of and behind the AOD.

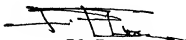
Hartmann discloses a laser-scanning microscope comprising two AODs.

*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kara E Geisel whose telephone number is 703 305 7182. The examiner can normally be reached on Monday through Friday, 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on 703 308 4881. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9306 for regular communications and 703 872 9306 for After Final communications. For inquiries of a general nature, the Customer Service fax number is 703 872 9317.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 1782.

  
F.L. Evans  
Primary Examiner  
Art Unit 2877

K.G.  
KEG  
November 17, 2003